National Semiconductor

Voltage Comparators

LM119/LM219/LM319 high speed dual comparator

general description

The LM119 series are precision high speed dual comparators fabricated on a single monolithic chip. They are designed to operate over a wide range of supply voltages down to a single 5V logic supply and ground. Further, they have higher gain and lower input currents than devices like the LM710. The uncommitted collector of the output stage makes the LM119 compatible with RTL, DTL and TTL as well as capable of driving lamps and relays at currents up to 25 mA. Outstanding features include:

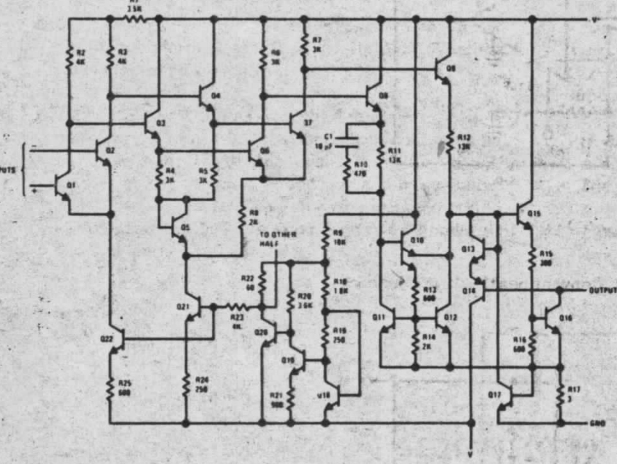
features

- Two independent comparators
- Operates from a single 5V supply
- Typically 80 ns response time at ±15V
- Minimum fan-out of 2 each side
- Maximum input current of 1 μA over temperature
- Inputs and outputs can be isolated from system ground
- High common mode slew rate

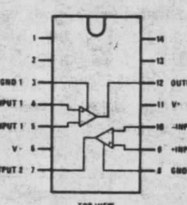
Although designed primarily for applications requiring operation from digital logic supplies, the LM119 series are fully specified for power supplies up to ±15V. It features faster response than the LM111 at the expense of higher power dissipation. However, the high speed, wide operating voltage range and low package count make the LM119 much more versatile than older devices like the LM711.

The LM119 is specified from −55°C to +125°C, the LM219 is specified from −25°C to +85°C, and the LM319 is specified from 0°C to +70°C.

schematic and connection diagrams



Dual-In-Line-Package



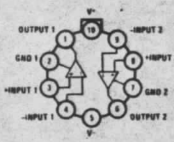
TOP VIEW

Order Number LM119D, LM219D
or LM319D
See NS Package D14E

Order Number LM319N
See NS Package N14A

Order Number LM119J, LM219J
or LM319J
See NS Package J14A

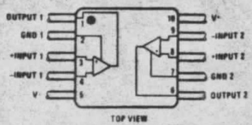
Metal Can Package



TOP VIEW

Order Number LM119H, LM219H
or LM319H
See NS Package H10C

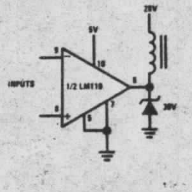
Flat Package



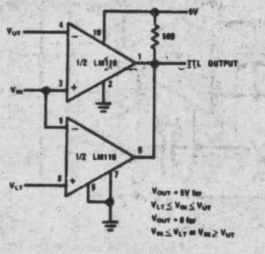
TOP VIEW

Order Number LM119F, LM219F
or LM319F
See NS Package F10A

typical applications



Relay Driver



Window Detector

---

abso
Total Supp
Output to
Ground to
Ground to
Differentia
Input Volt

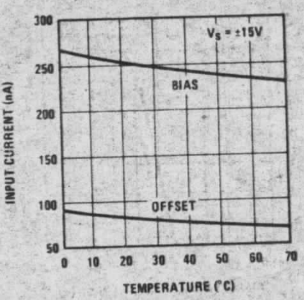
elect

Input C
Input O
Input B
Voltage
Respons
Saturati
Output I
Input Of
Input Of
Input Bi
Input Vo
Saturatio
Output L
Differenti
Positive S
Positive S
Negative S

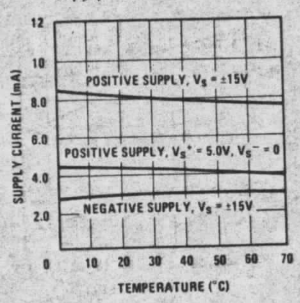
Note 1: Fo
Note 2: Th
elevated ter
ambient, or
mounted or
of the dual-i
Note 3: Th
wise stated.
offset curren
Note 4: The
ther supply
voltage gain
Note 5: The

typical performance characteristics LM319

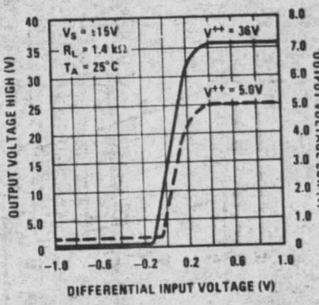
Input Currents



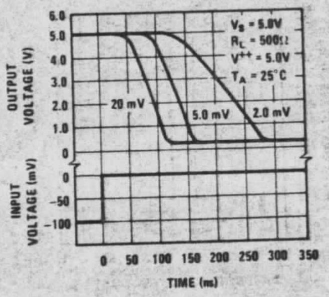
Supply Currents



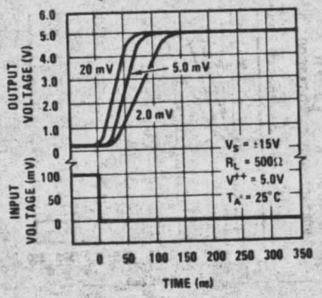
Transfer Function



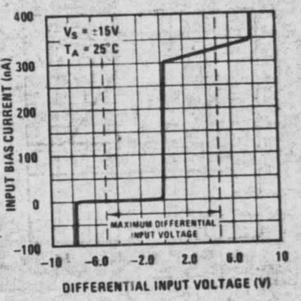
Response Time for Various Input Overdrives



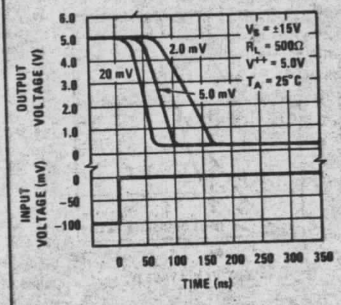
Response Time for Various Input Overdrives



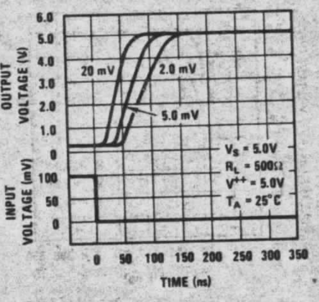
Input Characteristics



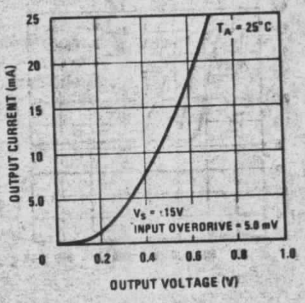
Response Time for Various Input Overdrives



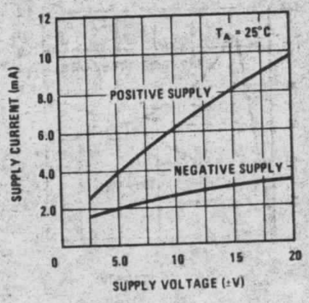
Response Time for Various Input Overdrives



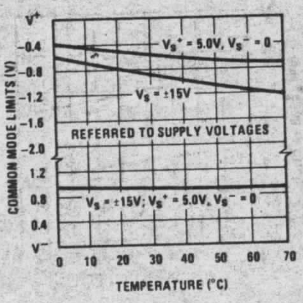
Output Saturation Voltage



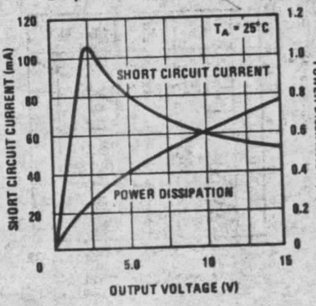
Supply Current



Common Mode Limits



Output Limiting Characteristics



absolute maximum ratings LM319

Total Supply Voltage	36V	Power Dissipation (Note 2)	500 mW
Output to Negative Supply Voltage	36V	Output Short Circuit Duration	10 sec
Ground to Negative Supply Voltage	25V	Operating Temperature Range LM319	0°C to 70°C
Ground to Positive Supply Voltage	18V	Storage Temperature Range	-65°C to 150°C
Differential Input Voltage	±5V	Lead Temperature (Soldering, 10 sec)	300°C
Input Voltage (Note 1)	±15V		

electrical characteristics (Note 3)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Input Offset Voltage (Note 4)	$T_A = 25°C$, $R_S \leq 5k$		2.0	8.0	mV
Input Offset Current (Note 4)	$T_A = 25°C$		80	200	nA
Input Bias Current	$T_A = 25°C$		250	1000	nA
Voltage Gain	$T_A = 25°C$	8	40		V/mV
Response Time (Note 5)	$T_A = 25°C$ $V_S = \pm 15V$		80		ns
Saturation Voltage	$V_{IN} \leq -10$ mV, $I_{OUT} = 25$ mA $T_A = 25°C$		0.75	1.5	V
Output Leakage Current	$V_{IN} \geq 10$ mV, $V_{OUT} = 35V$ $T_A = 25°C$		0.2	10	µA
Input Offset Voltage (Note 4)	$R_S \leq 5k$			10	mV
Input Offset Current (Note 4)				300	nA
Input Bias Current				1200	nA
Input Voltage Range	$V_S = \pm 15V$		±13		V
	$V^+ = 5V$, $V^- = 0$	1		3	V
Saturation Voltage	$V^+ \geq 4.5V$, $V^- = 0$ $V_{IN} \leq -10$ mV, $I_{SINK} \leq 3.2$ mA		0.3	0.4	V
Differential Input Voltage				±5	V
Positive Supply Current	$T_A = 25°C$, $V^+ = 5V$, $V^- = 0$		4.3		mA
Positive Supply Current	$T_A = 25°C$ $V_S = \pm 15V$		8	12.5	mA
Negative Supply Current	$T_A = 25°C$ $V_S = \pm 15V$		3	5	mA

Note 1: For supply voltages less than ±15V the absolute maximum input voltage is equal to the supply voltage.

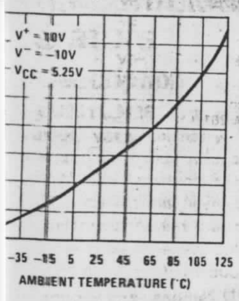
Note 2: The maximum junction temperature of the LM319 is 85°C. For operating at elevated temperatures, devices in the TO-5 package must be derated based on a thermal resistance of 150°C/W, junction to ambient, or 45°C/W, junction to case. The thermal resistance of the dual-in-line package is 100°C/W, junction to ambient.

Note 3: These specifications apply for $V_S = \pm 15V$ and $0°C \leq T_A \leq 70°C$, unless otherwise stated. The offset voltage, offset current and bias current specifications apply for any supply voltage from a single 5V supply up to ±15V supplies.

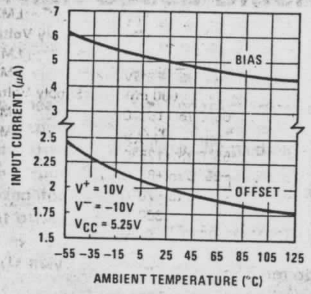
Note 4: The offset voltages and offset currents given are the maximum values required to drive the output within a volt of either supply with a 1 mA load. Thus, these parameters define an error band and take into account the worst case effects of voltage gain and input impedance.

Note 5: The response time specified is for a 100 mV input step with 5 mV overdrive.

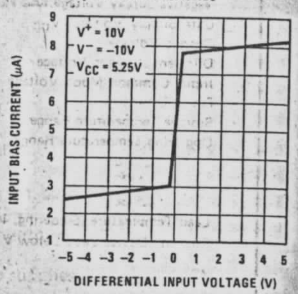
ffset Voltage



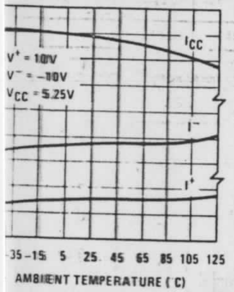
Input Currents vs Ambient Temperature



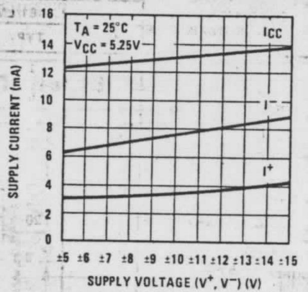
Input Characteristics



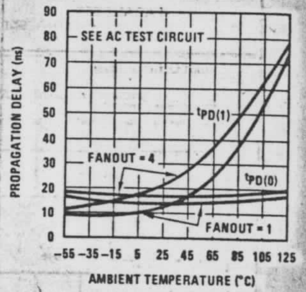
pply Current vs Ambient mperature



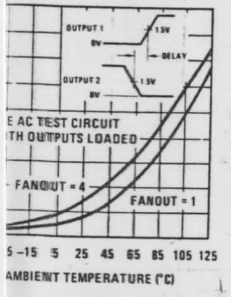
Supply Current vs Supply Voltage



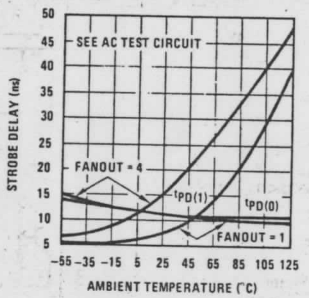
Propagation Delay vs Ambient Temperature



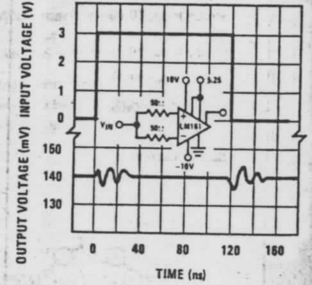
ay of Output 1 With spect to Output 2 vs bient Temperature



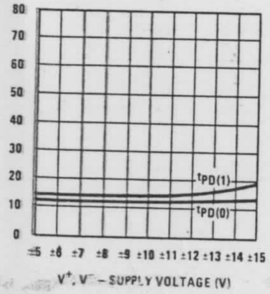
Strobe Delay vs Ambient Temperature



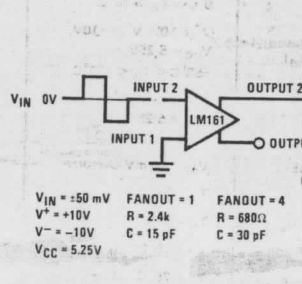
Common-Mode Pulse Response



Propagation Delay vs Supply Voltage



AC Test Circuit



LM193/LM293/LM393, LM193A/LM293A/LM393A, LM2903 Low Power Low Offset Voltage Dual Comparators

General Description

The LM193 series consists of two independent precision voltage comparators with an offset voltage specification as low as 2.0 mV max for two comparators which were designed specifically to operate from a single power supply over a wide range of voltages. Operation from split power supplies is also possible and the low power supply current drain is independent of the magnitude of the power supply voltage. These comparators also have a unique characteristic in that the input common-mode voltage range includes ground, even though operated from a single power supply voltage.

Application areas include limit comparators, simple analog to digital converters; pulse, squarewave and time delay generators; wide range VCO; MOS clock timers; multivibrators and high voltage digital logic gates. The LM193 series was designed to directly interface with TTL and CMOS. When operated from both plus and minus power supplies, the LM193 series will directly interface with MOS logic where their low power drain is a distinct advantage over standard comparators.

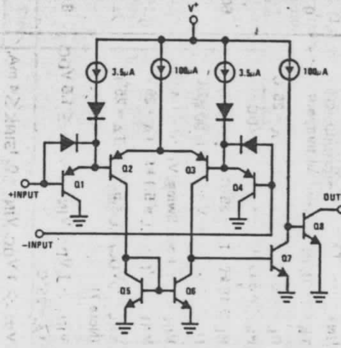
Advantages

- High precision comparators
- Reduced V_{OS} drift over temperature
- Eliminates need for dual supplies
- Allows sensing near ground
- Compatible with all forms of logic
- Power drain suitable for battery operation

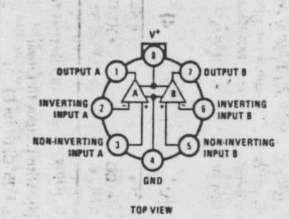
Features

- Wide single supply
  - Voltage range 2.0 V_{DC} to 36 V_{DC}
  - or dual supplies ±1.0 V_{DC} to ±18 V_{DC}
- Very low supply current drain (0.8 mA)—independent of supply voltage (1.0 mW/comparator at 5.0 V_{DC})
- Low input biasing current 25 nA
- Low input offset current ±5 nA
- and maximum offset voltage ±3 mV
- Input common-mode voltage range includes ground
- Differential input voltage range equal to the power supply voltage
- Low output saturation voltage 250 mV at 4 mA
- Output voltage compatible with TTL, DTL, ECL, MOS and CMOS logic systems

Schematic and Connection Diagrams

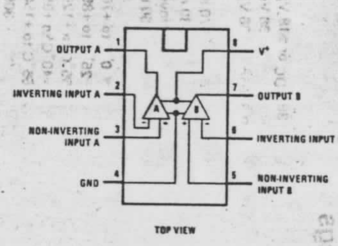


Metal Can Package



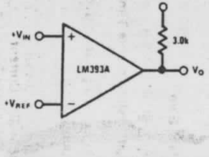
Order Number LM193H, LM193AH, LM293H, LM293AH, LM393H or LM393AH
See NS Package H08C

Dual-In-Line Package

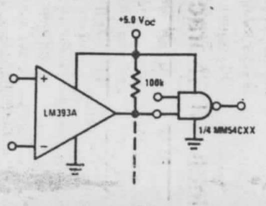


Order Number LM393N, LM393AN, or LM2903N
See NS Package N08B

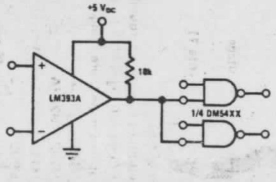
Typical Applications ($V^+ = 5.0\ V_{DC}$)



Basic Comparator



Driving CMOS



Driving TTL